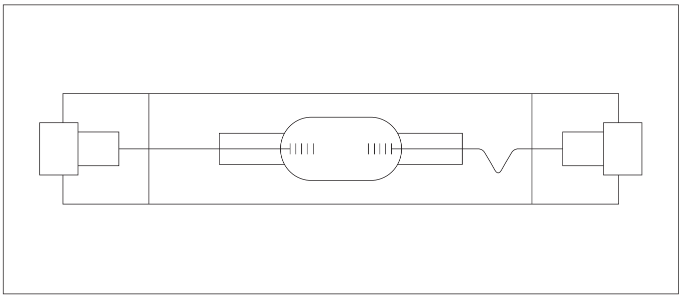
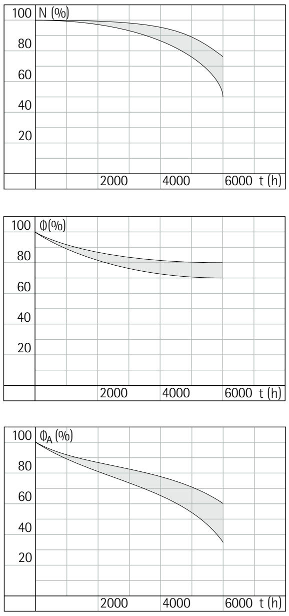
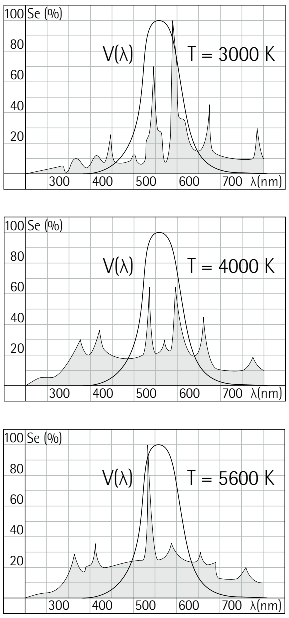
Double-ended metal halide lamp with compact discharge tube and quartz glass outer envelope.

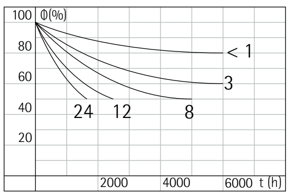




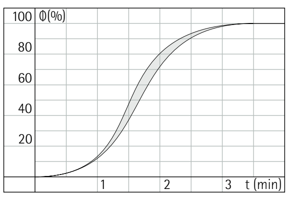
Proportion of functional lamps N, lamp lumens Φ and luminous flux of overall installation $Φ_A$ (as the product of both values) in relation to the operating time t.



Relative spectral distribution S_e (λ) of standard metal halide lamp with luminous colour warm white (above), neutral white (centre) and daylight white (below).



Decline in luminous flux Φ at different switching frequencies of 24, 12, 8, 3 and < 1 times per day.



Run-up characteristic: lamp lumens Φ in relation to time t.

2.3.2.7 Metal halide lamps

Metal halide lamps are a further development of mercury lamps and are therefore similar to these with regard to construction and function. Apart from mercury they also contain a mixture of metal halides. In contrast to pure metals, halogen compounds have the advantage that they melt at a considerably lower temperature. This means that metals that do not produce metal vapour when the lamp is in operation can also be used.

By adding metal halides, luminous efficacy is improved and, above all, colour rendering enhanced. If the metal combinations are correct then multi-line spectra can be produced, similar to those of fluorescent lamps; by using specific combinations it is possible to create a practically continuous spectrum consisting of numerous of spectral lines. Additional fluorescent substances to enhance colour rendering are not necessary. The mercury component primarily serves as an ignition aid and to stabilise the discharge process; when the metal halides have been evaporated via the initial mercury vapour discharge, these metal vapours essentially produce light.

The presence of halogens inside the lamp bulb means that auxiliary electrodes are not required as part of a starting device. Metal halide lamps require external control gear.

Metal halide lamps have excellent luminous efficacy and good colour rendering qualities; their nominal lamp life is high. They are extremely compact light sources, whose light can be easily controlled. The colour rendering and colour temperature of metal halide lamps is, however, not constant; it varies between individual lamps in a range and changes depending on the age of the lamp and the ambient conditions. This is particularly noticeable when it comes to the warm white lamps.

To operate metal halide lamps both an ignitor and a ballast are required. They require a run-up time of some minutes and a longer cooling time before restarting. Instant reignition is possible in the case of some double-ended types, but special ignitors or an electronic ballast is necessary. As a rule metal halide lamps cannot dimmed. The burning position is usually restricted.

Metal halide lamps are available in warm white, neutral white and daylight white, as single or double-ended tubular lamps, as elliptical lamps and as reflector lamps.

2.3.2.8 High-pressure sodium lamps

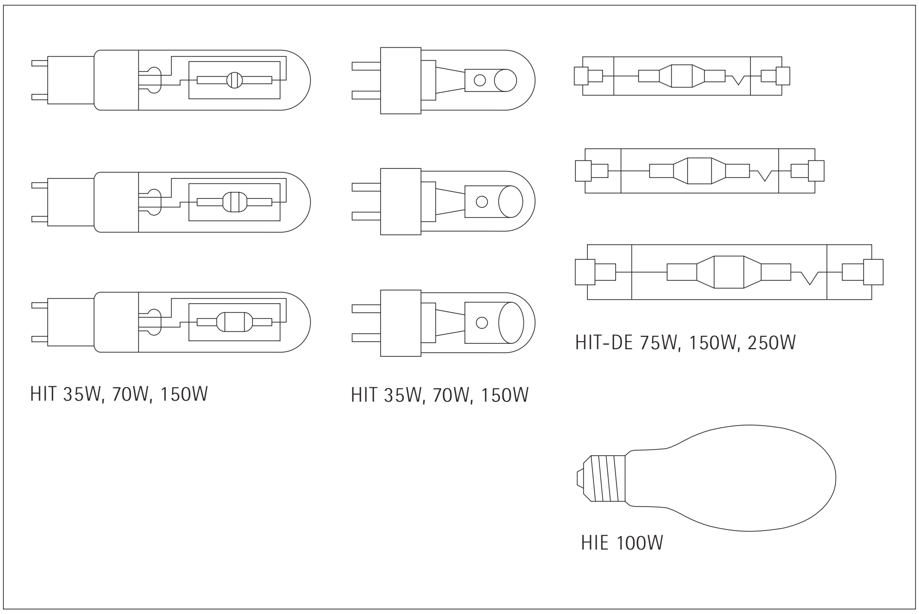
Similar to mercury lamps, the spectrum produced by sodium lamps can also be extended by increasing the pressure. If the pressure is sufficiently high the spectrum produced is practically continuous with the resultant enhanced colour rendering properties. Instead of the monochrome yellow light produced by the low-pressure sodium lamp, with the extremely poor colour rendering properties, the light produced is yellowish to warm white producing average to good colour rendering. The improvement in colour rendering is, however, at the cost of luminous efficacy. High-pressure sodium lamps are comparable to mercury lamps with regard to their construction and function. They also have a small discharge tube, which is in turn surrounded by a glass envelope. Whereas the discharge tube in high-pressure mercury lamps is made of quartz glass, the discharge tube in high-pressure sodium lamps is made of alumina ceramic, since high-pressure sodium vapours have an aggressive effect on glass. The lamps are filled with inert gases and an amalgam of mercury and sodium, such that the rare gas and mercury component serve to ignite the lamp and stabilise the discharge process.

The surrounding bulb of some high-pressure sodium lamps is provided with a special coating. This coating only serves to reduce the luminance of the lamp and to improve diffusion. It does not contain any fluorescent materials.

The luminous efficacy of high-pressure sodium lamps is not so high as that of low-pressure sodium lamps, but higher than that of other discharge lamps. These lamps have a long nominal lamp life. Colour rendering is average to good, distinctly better than that of monochrome yellow low-pressure sodium light.

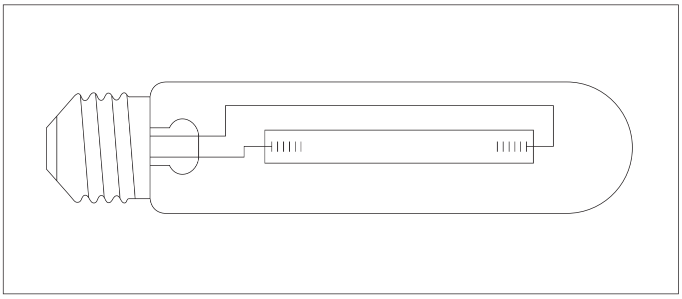
High-pressure sodium lamps are run on a ballast and require an ignition device. They require a run-up time of some minutes and cooling time before restarting. Instant re-ignition is possible in the case of some double-ended types, but special ignition devices or an electronic ballast is necessary. As a rule there are no restrictions as to the burning position.

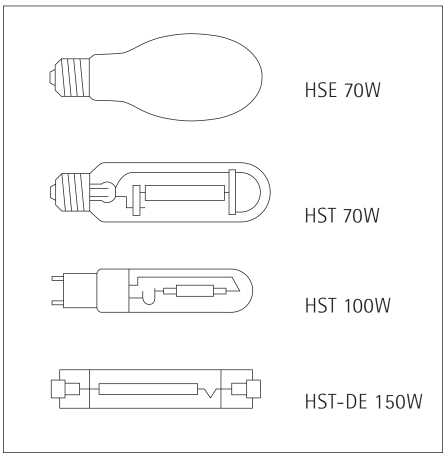
High-pressure sodium lamps are available as clear glass tubular lamps or with specially coated ellipsoidal bulbs. They are also available as compact, double-ended linear type lamps, which allow instant reignition and form an especially compact light source.



Standard metal halide lamps, single-ended (HIT) and double-ended versions (HIT-DE), plus elliptical version (HIE).

Single-ended high-pressure sodium lamp with ceramic discharge tube and additional outer glass envelope.





Standard high-pressure sodium lamps, single-ended elliptical (HSE), tubular (HST), and double-ended tubular (HST-DE).